Solubility constant, Ks

QUESTION: i) Write the equation for the equilibrium present in a saturated solution of the following substances
ii) write the expression for Ks for each of the following
iii) Calculate the solubility (or concentration) of the following substances in a saturated solution, in mol L^{-1}

FeS $K_s(FeS) = 4.90 \times 10^{-18}$
$Fe(OH)_2$ $Ks = 4.10 \times 10^{-15}$
$Zn(OH)_2$ $Ks = 3.00 \times 10^{-17}$
Ag_2CrO_4 $Ks(Ag_2CrO_4) = 3.00 \times 10^{-12}$

$AgCl$ K_s (AgCl) = 1.56×10^{-10}
$PbCl_2$ $K_s(PbCl_2) = 1.60 \times 10^{-5}$
$Mg(OH)_2$ $K_s(Mg(OH)_2) = 1.25 \times 10^{-11}$
$CaSO_4$ K_s ($CaSO_4$) = 2.45×10^{-5}
PbF_2 $K_s = 3.7 \times 10^{-8}$

Additional questions

1) Some sulfides have very low solubility products. When hydrogen sulfide gas is bubbled through solutions of these ions, these ions separate from a mixture of ions. In a saturated solution of hydrogen sulfide $[H_3O^+]^2[S^{2-}] = 1.10 \times 10^{-23}$ Calculate the sulfide ion concentration when the pH of the solution is 4.20.

2) Solid sodium chloride is added to 5.00 L of 0.100 mol L–1 silver nitrate solution.
Calculate the minimum mass of sodium chloride that would be needed to produce a saturated solution of AgCl. Assume that there is no change in volume when the sodium chloride is added. *M*(NaCl) = 58.5 g mol–1

3) a) Describe what is meant by the term '**solubility**'.

b) The solubility product, *K*s, of AgCl has a value of 1.56×10^{-10} at 25°C and this value increases to 2.15×10^{-8} at 100°C. Explain why *K*s is higher at 100°C. Include reference to the relevant equilibrium equation in your answer.

c) The chloride ion concentration in sea water can be determined by titrating a sample with aqueous silver nitrate ($AgNO_3$) using potassium chromate (K_2CrO_4) as the indicator.
As the silver nitrate is added, a precipitate of silver chloride, (AgCl) forms. When most of the AgCl has precipitated, the $Ag^+(aq)$ concentration becomes high enough for a red precipitate of Ag_2CrO_4 to form.
Show that the solubility of Ag_2CrO_4 in pure water at 25 °C is higher than that of AgCl. *K*s(AgCl) = 1.56 × 10–10 *K*s(Ag_2CrO_4) = 1.30×10^{-12}

d) If the concentration of chromate ions is 6.30×10^{-3} mol L^{-1} at the point when the Ag_2CrO_4 starts to precipitate, calculate the concentration of Ag^+ ions in the solution.